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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/659,577	09/10/2003	Lawrence T. Drzal	MSU 4.1-588	4666

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EXAMINER

COSTALES, SHRUTI S

ART UNIT	PAPER NUMBER
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1714

DATE MAILED: 08/24/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/659,577

Applicant(s)

DRZAL ET AL.

Examiner

Shruti S. Costales

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 10 September 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-28 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-28 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 28 January 2004 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input checked="" type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Specification

1. The abstract of the disclosure is objected to because the applicant does not set forth clearly that which is new in the art and to which the invention pertains. See MPEP § 608.01(b).

Applicant is reminded of the proper content of an abstract of the disclosure.

A patent abstract is a concise statement of the technical disclosure of the patent and should include that which is new in the art to which the invention pertains. If the patent is of a basic nature, the entire technical disclosure may be new in the art, and the abstract should be directed to the entire disclosure. If the patent is in the nature of an improvement in an old apparatus, process, product, or composition, the abstract should include the technical disclosure of the improvement. In certain patents, particularly those for compounds and compositions, wherein the process for making and/or the use thereof are not obvious, the abstract should set forth a process for making and/or use thereof. If the new technical disclosure involves modifications or alternatives, the abstract should mention by way of example the preferred modification or alternative.

The abstract should not refer to purported merits or speculative applications of the invention and should not compare the invention with the prior art.

- Where applicable, the abstract should include the following:
- (1) if a machine or apparatus, its organization and operation;
 - (2) if an article, its method of making;
 - (3) if a chemical compound, its identity and use;
 - (4) if a mixture, its ingredients;
 - (5) if a process, the steps.

Applicant is reminded of the proper language and format for an abstract of the disclosure.

The abstract should be in narrative form and generally limited to a single paragraph on a separate sheet within the range of 50 to 150 words. It is important that the abstract not exceed 150 words in length since the space provided for the abstract on the computer tape used by the printer is limited. The form and legal phraseology often used in patent claims, such as "means" and "said," should be avoided. The abstract should describe the disclosure sufficiently to assist readers in deciding whether there is a need for consulting the full patent text for details.

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The language should be clear and concise and should not repeat information given in the title. It should avoid using phrases which can be implied, such as, "The disclosure concerns," "The disclosure defined by this invention," "The disclosure describes," etc.

2. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

The following title is suggested: "A composite material having finely divided expanded graphite and a polymer having the expanded graphite dispersed therein, and methods for preparing a shaped composite".

Claim Objections

3. Claims 1-28 are objected to because the manner of numbering the claims is unclear as claim "-1-" may also be interpreted to mean page number due to the format of the number. It is suggested that the claims be renumbered to appear as, for example, "1. A composite material...".

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. Claims 1-5, 8-16, 18-20, and 23-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Saito et al. (U.S. Patent Number 6,024,900) in view of Adams et al. (U.S. Patent Number 6,200,915) and Ottinger et al. (U.S. Pre-Grant Publication Number 2002/0114952).

Saito discloses a carbon composite material which is a molded material comprising an expanded graphite powder and a thermoplastic resin or a thermosetting resin, wherein the expanded graphite powder is dispersed in the resin, and wherein the

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expanded graphite powder has an average particle diameter of 5-12 μm and at least 80% of the total particles of the expanded graphite powder have particle diameters of 0.1-20 μm (Col. 2, lines 21-31). The expanded graphite in Saito is obtained by adding sulfuric acid with hydrogen peroxide to raw graphite, therein intrinsically forming an expanded graphite precursor, then stirring, and then heating the precursor in an inert gas at a temperature of 500° – 1000° C (Col. 2, lines 54-65), therein intrinsically implying that the sulfuric acid and the hydrogen peroxide will be vaporized at such high temperatures. The thermoplastic resins that may be used include polyethylene, polystyrene, polypropylene, polymethyl methacrylate, polyethylene terephthalate, polybutylene terephthalate, polyethersulfone, polycarbonate, polyoxamethylene, polyamide, polyimide, polyamideimide, polyvinyl alcohol, polyvinyl chloride, fluororesin, polyphenylsulfone, polyether ether ketone, polysulfone, polyether ketone, polyarylate, polyetherimide, polymethylpentene and the like (Col. 4, lines 9-18). The thermosetting resin that may be used includes polycarbodiimide resin, phenolic resin, furfuryl alcohol resin, cellulose, epoxy resin, urea resin, melamine resin and the like (Col. 4, lines 19-24). The thermosetting resin or the thermoplastic resin may be used in the form of a powder or a solution in an appropriate solvent (Col. 4, lines 25-27).

A process for producing the carbon composite molded material is disclosed by Saito, wherein the expanded graphite and the thermoplastic or thermosetting resin are mixed and dispersed together and then the resulting mixture is pressure-molded at room temperature to 400° C (Col. 2, lines 32-49), therein intrinsically curing the resin. The carbon composite molded material has superior gas non-permeability and

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electroconductivity (Col. 8, lines 1-9), therein intrinsically implying that the expanded graphite present in the carbon composite molded material is present in an amount so that the composite material is conductive. The amount ratio of expanded graphite and the resin is 10-1000 parts by weight of resin per 100 parts by weight of expanded graphite powder (Col. 4, lines 38-48), resulting in a broad range of 9.1% - 90.1% by weight of expanded graphite in the carbon composite material, therein intrinsically providing less than 50% by volume of expanded graphite the composite material. However, it is to be noted that a prima facie case of obviousness exists where the claimed ranges and prior art ranges do not overlap but are close enough that one skilled in the art would have expected them to have the same properties. *Titanium Metals Corp. of America v. Banner*, 778 F.2d 775, 227 USPQ 773 (Fed. Cir. 1985). See M.P.E.P. § 2144.05. Therefore, it would have been obvious to one of ordinary skill in the art to add less than 8% by weight of the expanded graphite to the carbon composite material, as presently recited.

The difference between Saito and the presently claimed invention is the requirement that the expanded graphite consists essentially of single platelets and that the length of the platelets is less than about 200 microns and the thickness is than about 0.1 microns.

Adams, which is drawn to silicone-based coating compositions having reinforcing fillers (see Abstract), discloses laminar fillers having plate-like shapes, wherein the diameter of the plate is from 5 to 500 μm and the thickness is 1 to 100 Ångstroms, and wherein these fillers include expanded graphite (Col. 6, lines 58-67 and Col. 7, lines 1-

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17). Adams also discloses that the laminar filler – expanded graphite – having a height or thickness which is sufficiently smaller than the width and length can be agglomerated by clustering several of these laminar particles (Col. 7, lines 3-10). Although Adams is silent with respect to the importance of such a laminar structure of the expanded graphite, Ottinger, which is drawn to a synthetic resin-impregnated body made of expanded graphite (Page 1, paragraph [0002]), discloses that the platelet shaped (i.e., laminar) expanded graphite particles slide in over one another becoming interlocked so as to never be released without destruction (Page 3, paragraph [0036]). It would have been obvious to one of ordinary skill in the art to use the laminar plate-like shaped expanded graphite with specified dimensions as disclosed by Adams and Ottinger in Saito's composition because the platelet shaped (i.e., laminar) expanded graphite particles slide in over one another becoming interlocked so as to never be released without destruction giving rise in the composite material a porous graphite framework or network which has good electrical as well as thermal conductivity due to the good contacts between the graphite platelets, wherein these properties are not affected by impregnation with synthetic resin (Col. 3, paragraph [0036]), thereby obtaining the invention as set forth in the presently cited claims.

6. Claims 6-7, 17, and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Saito in view of Adams and Ottinger as applied to claims 1-5, 8-16, 18-20, and 23-24 above, and further in view of Blain et al. (U.S. Patent Number 6,413,601) and Cha et al. (U.S. Patent Number 5,164,054).

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The discussion above regarding Saito, Adams, and Ottinger in paragraph 5 is herein incorporated by reference.

The difference between Saito in view of Adams and Ottinger and the presently claimed invention is the requirement that the expanded graphite has been formed in a radiofrequency wave applicator by heating a graphite precursor with radiofrequency waves or the expanded graphite is made by microwave or RF heating and that the polymer and the expanded graphite have been heated together with a radiofrequency wave applicator.

Blain, which is drawn to a thermal insulating device (Col. 1, lines 7-15), discloses the exfoliation of graphite flakes by exposing them to a heat sources such as microwave or radio frequency radiation (Col. 5, lines 1-7). Although Blain is silent with respect to using a radiofrequency wave applicator, Cha, which is drawn to the use of radiofrequency energy as a non-chemical catalyst (Col. 1, lines 11-13), discloses that a traveling wave applicator or waveguide is used to transfer radiofrequency energy (Col. 6, lines 28-34). It would have been obvious to one of ordinary skill in the art to use a heat source such microwave or radiofrequency radiation for the exfoliation of graphite or for curing resin as disclosed by Blain and Cha in Saito's composite material because a wave applicator can be used to transfer radiation energy inside a reactor (Col. 6, lines 28-34), therein maintaining confinement during these processes, thereby obtaining the invention as set forth in the presently cited claims.

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7. Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Saito in view of Adams and Ottinger and further in view of Greinke et al. (U.S. Patent Number 6,555,271).

The discussion above regarding Saito, Adams, and Ottinger in paragraph 5 is herein incorporated by reference.

The difference between Saito in view of Adams and Ottinger and the presently claimed invention is the requirement that the anode in a battery has a finely divided microwave or RF expanded graphite having single platelets with a length less than about 200 microns and a thickness of less than about 0.1 microns.

Greinke, which is drawn to the production of an anode in a battery (Col. 1, lines 5-6), discloses an anode is produced by particles of exfoliated graphite (Col. 3, lines 37-50). It would have been obvious to one of ordinary skill in the art to use exfoliated or expanded graphite in an anode of a battery as disclosed by Greinke because as disclosed by Saito in view of Adams and Ottinger, expanded graphite is a good conductor of electricity (see page 3, paragraph [0036] of Ottinger), it would have therefore been obvious to use a good conductor of electricity to form an anode in a battery for proper functioning, thereby obtaining the invention as set forth in the presently cited claims.

8. Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Saito in view of Adams and Ottinger and further in view of Bonville (U.S. Patent Number 6,248,462).

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The discussion above regarding Saito, Adams, and Ottinger in paragraph 5 is herein incorporated by reference.

The difference between Saito in view of Adams and Ottinger and the presently claimed invention is the requirement that the substrate having a catalytic material deposited thereon wherein the catalytic material is used for the conversion of an organic compound to hydrogen, the substrate having a finely divided microwave or RF expanded graphite having single particles with a length less than about 200 microns and a thickness of less than about 0.1 microns.

Bonville, which is drawn to a fuel cell assembly (Col. 1, lines 7-11), discloses that hydrocarbon fuels may be converted into hydrogen (Col. 2, lines 24-34) and that to accomplish this efficiently a fuel cell is described as having an anode catalyst formed from porous graphite (Col. 4, lines 10-20), wherein the anode catalyst corresponds to the graphite substrate having a catalyst deposited thereon. It would have been obvious to one of ordinary skill in the art to make a substrate-catalyst as described in Bonville by using Saito in view of Adams and Ottinger's expanded graphite because expanded graphite is a good conductor of heat and electricity (see page 3, paragraph [0036] of Ottinger), it would have therefore been obvious to use a good conductor of heat and electricity to perform high temperature catalytic conversion of hydrocarbons into hydrogen, thereby obtaining the invention as set forth in the presently cited claims.

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9. Claims 26-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Saito in view of Adams and Ottinger as applied to claims 1-5, 8-16, 18-20, and 23-24 above, and further in view of Von Bonin et al. (U.S. Patent Number 5,288,429).

The discussion above regarding Saito, Adams, and Ottinger in paragraph 5 is herein incorporated by reference.

The difference between Saito in view of Adams and Ottinger and the presently claimed invention is the requirement that the expanded graphite is grafted with an acrylamide.

Von Bonin, which is drawn to the production of mouldings from expanded graphites (Col. 1, lines 5-7), discloses water-containing mixtures including acrylamide in the moist preparation of expandable graphite (Col. 3, lines 8-15). It would have been obvious to one of ordinary skill in the art to use acrylamide with expanded graphite because acrylamide has an adhesive and thickening effect on the graphite (Col. 3, lines 8-15), thereby obtaining the invention as set forth in the presently cited claims.

Conclusion

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shruti S. Costales whose telephone number is (571) 272-8389. The examiner can normally be reached on Monday - Friday, 6:30 AM - 3:00 PM.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vasu Jagannathan can be reached on (571) 272-1119. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at (866) 217-9197 (toll-free).

SSC
Shruti S. Costales
August 22, 2005

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